CHAPTER:12

ATOMS

One mark questions

1) Who proposed the first atom model? (K)
2) What is the name of the atom model given by J.J.Thomson? (K)
3) Is an atom electrically neutral? (K)
4) What are the constituents of an atom according to J.J.Thomson? (K)
5) Name the model of atom given by Rutherford. (K)
6) In Geiger-Marsden experiment which element is used as a source of α-particles? (K)
7) Who was first credited to discover the nucleus? (K)
8) What is the magnitude of charge on α-particle? (K)
9) In α-particle scattering experiment, which implication has led Rutherford to conclude that the mass of the atom is concentrated in a small volume? (K)
10) Which experiment determines the upper limit to the size of the nucleus? (K)
11) Name the experiment responsible for the discovery of atomic nucleus. (K)
12) How do we define angle of scattering in α-particle scattering experiment? (U)
13) Who discovered the nucleus of an atom? (K)
14) What was Balmer's contribution for the study of hydrogen spectrum? (K)
15) Define the term 'impact parameter in α-particle scattering experiment. (U)
16) Name the series of hydrogen spectrum which has least wavelength. (K)
17) Name the series of hydrogen spectrum that lies in UV region.
18) To which part of the electromagnetic spectrum does Lyman series belong? (K)
19) Name the series of hydrogen spectrum which lies in the visible region. (K)
20) To which part of the electromagnetic spectrum does Balmer series belong? (K)
21) To which part of the electromagnetic spectrum does Paschen series belong? (K)
22) An electron transits from 5th orbit to 3rd orbit in hydrogen atom, Name the region of the spectral line to which it belongs. (U)
23) What is meant by the series limit of a spectral series? (K)
24) Which force provides the centripetal force required for the electron to go round the nucleus in uniform circular motion in Bohr atom? (K)
25) What does a stationary orbit mean according to Bohr in his atom model? (K)
26) Does an electron revolving round a nucleus in a Bohr atom radiate energy? (K)
27) Write Bohr's quantisation rule. (K)
28) When does an atom radiate energy according to Bohr's theory? (K)
29) How does the radius of the Bohr orbit vary with its principal quantum number? (K)
30) Are the electron orbits in hydrogen atom equally spaced? (K)
31) How does the energy of an electron vary with its principal quantum number? (U)
32) What is the significance of the negative sign in the expression of energy of an electron? (U)

33) What type of emission spectra is given by atoms? (K)
34) What is line emission spectrum? (K)
35) What is absorption spectrum? (K)
36) How absorption spectrum is obtained? (K)
37) What causes a line spectrum? (K)
38) Name a source of line emission spectrum. (K)
39) What kind of spectrum is obtained when substances are excited in their atomic state? (K)
40) What information do we get by the study of line spectrum? (K)
41) How is the wave number of a spectral line related to its wavelength? (U)
42) What is the value of Rydberg's constant? (K)
43) What is meant by the energy level diagram for an atom? (U)
44) In Bohr's atomic model which energy level corresponds to the minimum energy? (K)
45) What is ionization energy? (K)
46) What is excitation energy? (K)

Two mark questions

1. Who proposed plum pudding model for atom? Describe the arrangement of constituents of atom in it. (K)
2. Who discovered electron? And which experiment has led to its discovery? (K)
3. Who proposed planetary model of atom? Explain how the constituents of atom are arranged according to this model. (K)
4. Mention the two draw backs of Rutherford's atom model. (K)
5. Show graphically the variation of number of α-particle scattered with the scattering angle for a given energy of α-particle. (S)
6. Draw a schematic diagram of Geiger-Marsden α-particle scattering experiment. (S)
7. When the impact parameter is said to be (a) maximum? & (b) minimum? (K)
8. Give the names of first two members of the Balmer series. (K)
9. Calculate the wavelength of H_α-line using Balmer formula. Given Rydberg constant= $1.097X10^7 m^{-1}$. **(A)**
10. Write Balmer formula for the wavelengths of spectral series of hydrogen atom and explain the terms. (K)
11. How do we get series limit using Balmer formula? Write the value of the shortest wavelength in the Balmer series. (K)
12. Write the empirical formula for wave number of first two spectral series. (K)
13. Write Bohr's frequency condition and explain the terms. (K)
14. What is 'Bohr radius'? Write its formula.(K)
15. Write the expression for Rydberg's constant and explain the terms. (K)
16. Write the formula for the energy of electron in n^{th} Bohr orbit of hydrogen atom in electron volt and write the value for the third orbit. (U)

Three mark questions

1. What are the experimental observations of Geiger-Marsden's scattering experiment? (K)
2. Explain briefly the conclusions of Rutherford α-particle scattering experiment. (U)

3. Draw the trajectories traced by different alpha particles in Geiger-Marsden experiment. (S)
4. Define impact parameter in α-scattering experiment. How does the scattering angle depends on impact parameter and what is the conclusion drawn by Rutherford by analyzing this? (U)
5. State the basic assumptions of the Rutherford nuclear model of an atom. (K)
6. Name the first three spectral series of hydrogen atom. (K)
7. State the postulates of Bohr's theory of hydrogen atom. (K)
8. Sketch the energy level diagram of hydrogen atom. (S)
9. Obtain the Bohr's quantisation condition on the basis of de-Broglie's theory (wave picture of an electron). (U)
10. Mention any three limitations of Bohr's atom model. (K)

Five mark questions

1. Explain with a schematic diagram, Geiger-Marsden experiment of α-particle scattering. (U)
2. Derive the expression for the total energy of an electron in a hydrogen atom on the basis of Rutherford's atom model.(U)
3. Explain spectral series of hydrogen atom. (U)
4. Derive the expression for the radius of n^{th} stationary orbit of hydrogen atom using Bohr's postulates. (U)
5. Derive the expression for the total energy of an electron in n^{th} stationary orbit of hydrogen atom by assuming the expression for orbit radius. (U)
6. Derive the expression for the frequency of radiation in hydrogen spectrum assuming the expression for energy of electron in a stationary orbit. (U)

Numerical problems.

1. The wavelength of the first member of the Balmer series in the hydrogen spectrum is 656.3nm. Calculate the wavelength of the first member of the Lyman series in the same spectrum. (A) **[121.54 nm]**
2. The energy of an excited hydrogen atom is -3.4eV. Calculate the angular momentum of the electron according to Bohr's theory.(A) **[$2.11X10^{-34}$Js]**
3. A doubly ionized lithium atom has atomic number 3. Find the wavelength of the radiation required to excite the electron in Li^{+2} from the first to the third Bohr orbit. Assume that the ionization energy is 13.6eV. (A) **[113.74 A^0]**
4. A stationary He^+ emitted a photon corresponding to the first line of Lyman series. This photon liberated a photo electron from a stationary hydrogen atom in the ground state. Find the velocity of the photo electron. (A) **[$3.1X10^6 ms^{-1}$]**
5. A hydrogen atom rises from its n=1 state to the n=4 state by absorbing energy. If the potential energy of the atom in n=1 state is -13.6 eV, calculate the potential energy in n=4 state and energy absorbed by the atom in the transition from n=1 to n=4 state. (A)
6. Calculate the de Broglie wavelength of a neutron moving with a kinetic energy 150 eV, and an electron accelerated by a voltage of 50KV. given mass of the neutron = $1.675X10^{-27}$Kg, and that of electron = $9.1X10^{-31}$ Kg. (A) **[$2.3X10^{-12}$ m, $5.5X10^{-12}$ m]**

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